North Carolina’s energy industry is faced with a changing landscape, where customers want more clean energy delivered through a reliable and intelligent system for a host of new uses. Its members — including the nation’s largest utility, leading solar energy developers, world-class educators and technology developers — have responded by blazing new trails. They are developing energy sources and adding technology while maintaining time-tested generators. Follow their work inside these pages.
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North Carolina has many riches, but none are fossil fuels. There’s nary a lump of coal or drop of crude to be found from Manteo to Murphy. But it makes up for its lack with plentiful sources of renewable energy.

Washington, D.C.-based Solar Energy Industries Association says North Carolina had the second-most installed solar capacity in the country through 2016. Its biofuel resources are the country’s third richest, says Gus Simmons, vice president and director of bioenergy for Winston-Salem-based consulting firm Cavanaugh & Associates. “There is an immense resource base, and most dominant are agricultural resources such as pork, poultry, crops and forestry products.”

Simmons is working with Wilmington-based Optima BioEnergy, which uses anaerobic digestion to turn hog waste into natural gas. Piedmont Natural Gas Co., a subsidiary of Charlotte-based Duke Energy Corp., recently agreed to build lines that will allow the natural gas Optima produces at three Duplin County hog farms to be used as renewable energy. “The amount of natural gas we produce is really a small fraction of the amount we consume in the state, but it’s an important first step,” he says.

The Optima project comes at an opportune time for the state’s hog industry, says Angie Maier, the North Carolina Pork Council’s director of government affairs and sustainability. “Because of a 2007 moratorium on new swine farms in North Carolina, there has been no new swine-farm expansion, and renewable-energy opportunities give the farmers a new use for their product. The Optima project is exciting — the first of its kind in North Carolina — and represents the first native natural gas to be harnessed from our state’s resources.”

Even though North Carolina is home to plenty of pigs — 9.3 million in 2016, according to the U.S. Department of Agriculture — making waste-to-energy economics work is tough, Maier says. “The viability of using hog waste for energy depends on production methods, the size of the farms, how the swine are raised and how the waste is maintained. You have to have a lot of pigs concentrated in close proximity. Optima’s work is a small but important part of what is to come later.”
North Carolina is harnessing its abundant sunshine, too. Enough solar energy is generated, mostly in eastern counties, to meet more than 5% of the state’s electricity needs, according to a 2017 Environment North Carolina Research and Policy Center report. Solar production in North Carolina increased to 4,016 gigawatts in 2016, up from 1 gigawatt a decade earlier.

Solar energy production isn’t showing signs of slowing. Mooresville-based SunEnergy1 LLC has helmed large-scale solar power projects on the East Coast for nearly a decade, says company CEO Kenny Habul. It sources land, executes power-purchase agreements, and designs, engineers and constructs solar farms. The company owns or leases 10,000 acres in development, with 5 gigawatts of power in the pipeline.

SunEnergy1 developed Summit Farms with 250,000 solar panels on 700 acres near Moyock in Currituck County and is currently developing its neighbor, Ranchland, another 700-acre site that’s home to 250,000 solar panels as well. “Last year we sold the Summit site to Dominion Energy of Virginia, and the energy will be used to power the Massachusetts Institute of Technology, Boston Medical Center and Post Office Square Redevelopment Corp. of Boston,” Habul says. Ranchland is owned by SunEnergy1 and sells power to Digital Realty Trust Inc. and other corporate and institutional partners.

John Morrison is chief operating officer of San Francisco-based solar-power developer EcoPlexus Inc. and former assistant secretary of energy at N.C. Department of Commerce. He says the renewable energy tax credits that the N.C. legislature put in place more than a decade ago are responsible for the state’s lofty position in the solar-energy industry. “The typical solar farm averages 30 to 40 acres in size and generates about 5 [megawatts] of energy. Since 2007, a lot of solar farms were set up and are running at that capacity.”

North Carolina lawmakers passed and Gov. Roy Cooper signed House Bill 589 last summer. It changes the way solar energy is generated in the state, including a competitive solicitation process for new utility-scale solar farms such as those that SunEnergy1 develops. It also adds a rooftop solar leasing program and one that allows utility customers to offset their electricity purchases by selling back the renewable energy they generate. And it calls for the state’s solar-energy capacity to double over the next four years.

Before these changes, solar-energy developers operated on a standard contract that was established by the N.C. Utilities Commission. It was viewed as beneficial for small developers. “Under standard contracts, small companies knew they could invest in solar sites and get viable returns,” Morrison says. “They knew how much they needed to invest, and they knew how to budget for their sites.”

Roger Bredder is Tempe, Ariz.-based First Solar Inc’s vice president for business development, but he works from Charlotte. He says the newly minted renewable-energy law benefits large solar developers. It helps transition the market to utility-scale projects — 50 to 100 megawatts — and that will bring more growth. “It is phenomenal how far we’ve come, and there’s a lot more room for growth. Adding to that is the costs are falling. The price of [panels] has dropped 50% from when I started. The cost of building solar plants is becoming cost competitive, too.”

There’s more help in the renewable-energy law. It expedites reviews of connecting animal waste-to-energy projects to the grid, for example, which could spur their growth. Maier believes that gives hog farmers reason to be optimistic. “The Pork Council recently met with about 100 farmers in Duplin County about new opportunities, and if the economics work, they’ll be on board. Their margins are thin. They can’t take on expense without an expected return, but I’m starting to see their heads nodding, and they are starting to get it.”

The law includes a moratorium on permits for wind farm construction and expansion until the end of the year. That stopped two projects that were proposed for eastern North Carolina and caused this sector’s sails to go limp in the state.

Morrison predicts solar energy will continue to be a significant part of the energy generation portfolio, thanks to technological developments. “Over the next three to five years, we’ll see energy storage come into play. Electricity has to be consumed as it is generated. Click on a switch and energy flows, and the times when it is not flowing, a generator kicks in. So, there is the development of batteries and other storage devices that will play an important role.”

Simmons is equally optimistic about biofuels. “The future is fantastic. Our rich resources give us a huge opportunity to harvest biomass, put it to use, and to put us on the path to increased energy security and independence.”

— Teri Saylor is a freelance writer from Raleigh.

North Carolina is flush with renewable energy sources. Wilmington’s Optima BioEnergy, for example, is turning hog waste to natural gas in Duplin County.
Rewired relationship

Technology is changing how utilities provide energy to and interact with their customers.

North Carolina regularly ranks at the top of superlative lists such as the best state in which to live, work or start a business. Those accolades have spurred growth in its population, which U.S. Census Bureau estimated at 10.2 million in 2016, up from 8.9 million a decade earlier.

But as its population continues to increase, energy use in North Carolina is leveling off. Washington, D.C.-based U.S. Energy Information Administration says 57,902 million kilowatt hours of residential retail electricity was sold in 2015, compared with 62,160 in 2010 and 54,073 in 2005. It’s neither by magic nor residents sitting in the dark. It’s the result of technology, which is changing the way energy is used and how utilities and their customers interact.

Charlotte-based Duke Energy Corp. provides electricity to most North Carolinians. The exceptions are the extreme northeastern corner of the state, which is supplied by Richmond, Va.-based Dominion Energy Inc., and portions of 93 of the state’s 100 counties that are served by 26 independent electric cooperatives. Municipalities and universities own and operate more than 70 electric systems in the state.

Under the traditional model, utilities build assets by selling electricity. Those assets fuel capital investment, earn a return on investments and cover expenses. But Lee Mazzocchi, senior vice president of grid solutions for Duke, says the model is evolving. Utilities are modernizing their grids, introducing smart meters, experimenting with energy-storage devices and diversifying generation. “These changes in energy resources and technology are bringing about changes in how utilities provide energy as a service going forward. Back in the day, large power plants were a centralized power generator, which sent energy through transmission lines to distribution stations to customers. Today, we are focused less on central energy production and more on smaller distribution centers across the system.”

But it’s not only the utilities that are changing. Mazzocchi says technology is giving consumers the opportunity to be more involved.

“They want to use technology for services such as receiving energy usage alerts. They want to be able to actively control their energy costs. We are moving toward an era of delivering a more value-added service to the customer, including providing more information and being more customer focused. The customer is getting more choice and control over their experience, and we want to be involved. As we see technology being constructive overall and efficient, we want to make sure customers have more control while we manage to keep costs low and the infrastructure reliable.”

Technology is disrupting the traditional utility model in other ways, including solar energy, electric vehicles and battery storage, says Peter Schwarz, professor of economics at UNC Charlotte’s Belk College of Business. Today, consumers can generate their own electricity through solar panels installed on their home’s roof, for example, and use it in their electric vehicles or store it in batteries.

The established power grid, the interconnected network that delivers electricity...
from producers to consumers, is adding technology in order to keep up with those new demands. Schwarz says smart-grid technology increases efficiencies and reduces costs. Instead of sending power only from producers to consumers, it captures information about energy consumption and uses that data to increase efficiency. It could even provide real-time usage to customers and reroute the flow of electricity around downed wires or other problems.

Microgrids are local energy grids connected to the main grid. But in times of crisis, such as storms or power outages, they can operate independently, sometimes powered by a combination of renewable-energy generation and storage, maintaining service to their customers. The U.S. Energy Department is promoting them as a more reliable and flexible way for consumers to receive electricity. They also can cut costs and provide power to those communities too small or remote for traditional grid use. Local communities can use them for energy independence, and they are more environmentally friendly in some cases.

The District of Columbia and 29 states have some form of energy deregulation for gas, electricity or both, according to Washington, D.C.-based trade group American Coalition of Competitive Energy Suppliers. Those are free markets where any approved provider can sell energy to consumers. Energy remains regulated in North Carolina, where only utility companies can sell it to consumers. There is no competitive pricing structure because the N.C. Utilities Commission sets rates.

Chris Ayers, executive director of the commission’s Public Staff, an advocate for utility customers, doesn’t see the state deregulating energy anytime soon. “When rates are regulated, they must be just and reasonable. This cost-of-service model can be rigid, but it helps protect consumers from market swings, and it keeps the rates below the national average.” U.S. Energy Information Administration reported the average retail price for residential electricity in North Carolina was 11.8 cents per kilowatt hour in September 2017. Hawaii had the highest average cost, 29 cents, and the national average was 13.3 cents.

Ayers predicts customers will continue to see changes in the way energy is generated and distributed as storage, such as batteries, becomes scalable in a cost-effective way. It’s an important part of expanding generation from renewable sources such as solar, which doesn’t produce on cloudy days or at night. “From a small device that will store enough energy to charge your cellphone, to a large battery that will store enough energy to power the city of Raleigh for two hours, technology may ultimately change the way energy is delivered in the future.”

— Teri Saylor is a freelance writer from Raleigh.
North Carolina's nuclear power plants have provided an important source of electricity for nearly a half-decade. Industry experts say that role won't change soon.

North Carolina's first nuclear power plant — Brunswick Nuclear Generating Station near Southport — opened almost 45 years ago. It has outlasted its builder, Carolina Power & Light Co., which became Progress Energy when it merged with Florida Progress Energy in 2000 and then a subsidiary of Charlotte-based Duke Energy Corp., the country's largest utility, in 2012. The plant, however, continues to produce electricity.

North Carolina's net electricity generation from nuclear provided 5.3% of the nation's total electricity in 2016, according to Washington, D.C.-based U.S. Energy Information Administration. That was fourth-most among the 50 states. Nuclear provided the biggest portion — 32.5% — of North Carolina's electricity generation. Industry experts expect this "clean" energy supply, which contributes 57% of the nation's and 87% of North Carolina's zero-carbon electricity, will continue to carry that load for years to come.

Duke operates 11 nuclear reactors on six sites, including Brunswick, Harris Nuclear Plant in Wake County and McGuire Nuclear Station in Mecklenburg County. Steve Nesbit, the utility's director of nuclear policy and support, says they create 2,600 jobs and an annual payroll of $203 million. “Nuclear plants are valuable assets for our region," he says. “They provide good jobs, steady employment and a revenue source for local communities. These plants have been performing well since the 1970s, and they are under 40-year license agreements granted through the Nuclear Regulatory Commission. The license agreements could be extended into the 2050s and 2060s, which means the nuclear fleet in operation here can remain in operation for decades to come."

But it won't be entirely smooth sailing. Energy sources are becoming more diverse, says Rocky Seese, owner and CEO of Charlotte-based SOS Intl., which provides training and compliance services to utilities. "While coal-fired units are starting to be retired, it still ranks as the third top fuel source behind natural gas and nuclear. Then below that comes solar, wind, hydro-electricity and biofuels."

Nesbit sees the value in generating electricity from several sources and believes each has a role to play. "We have a diverse grid and diverse energy resources yielding a reliable and resilient supply of electricity. Natural gas has increased and has driven down the cost of generating electricity from gas. Nuclear energy also is a low-cost source of energy, and North Carolina's energy costs are among the least expensive in the country."
Last summer, low demand and Monroeville, Pa.-based nuclear-technology supplier Westinghouse Electric Co.’s bankruptcy caused Duke to cancel construction plans for Lee Nuclear Station in Cherokee County, S.C. Its license is valid for 18 more years, so the project will continue to be evaluated, Nesbit says.

While construction of large nuclear power plants is slowing, the sector will see growth from the development of small modular reactors. They are built in factories and moved to where they are needed, reducing construction costs. They incorporate technology that makes them safer and more environmentally friendly than larger reactors, says Carl Fisher, vice president of hardware modernizations and nuclear parts center for France-based AREVA Group’s AREVA NP. It develops nuclear-power technology and has offices in Charlotte. “AREVA has designed a Generation IV reactor to provide high temperature steam for industrial use and electricity production.” It also is developing a sodium-cooled fast neutron reactor, which can run on the waste produced by other reactors.

One issue that the nuclear-energy industry has wrestled with for more than 30 years is disposal of radioactive waste. The Government Accountability Office estimates that more than 90,000 metric tons of nuclear waste needs disposal in the U.S. Electricity generation contributed 80,000 metric tons of that. The balance is from the nation’s nuclear weapons program.

In 1987, Congress directed the U.S. Department of Energy to investigate Yucca Mountain in Nevada for a national repository of spent nuclear fuel, but its license is still pending. “The Yucca Mountain site was chosen for its geological superiority,” Fisher says. “It’s a dry area and seismically stable, but local politics and the lack of funding have caused the efforts to grind to a standstill.”

Spent nuclear fuel is currently stored at reactor sites, Fisher says. AREVA does provide waste-management services and operates nuclear-waste repositories in Europe.

— Teri Saylor is a freelance writer from Raleigh.